UXO Clearance Technology Requirements at Active Test and Training Ranges

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Outline

- Why active range clearance?
- Tri-Service coordination and policy
- Requirements determination process
- Technology requirements

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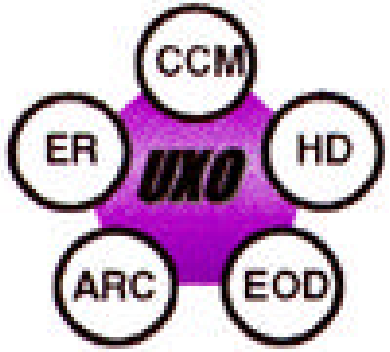
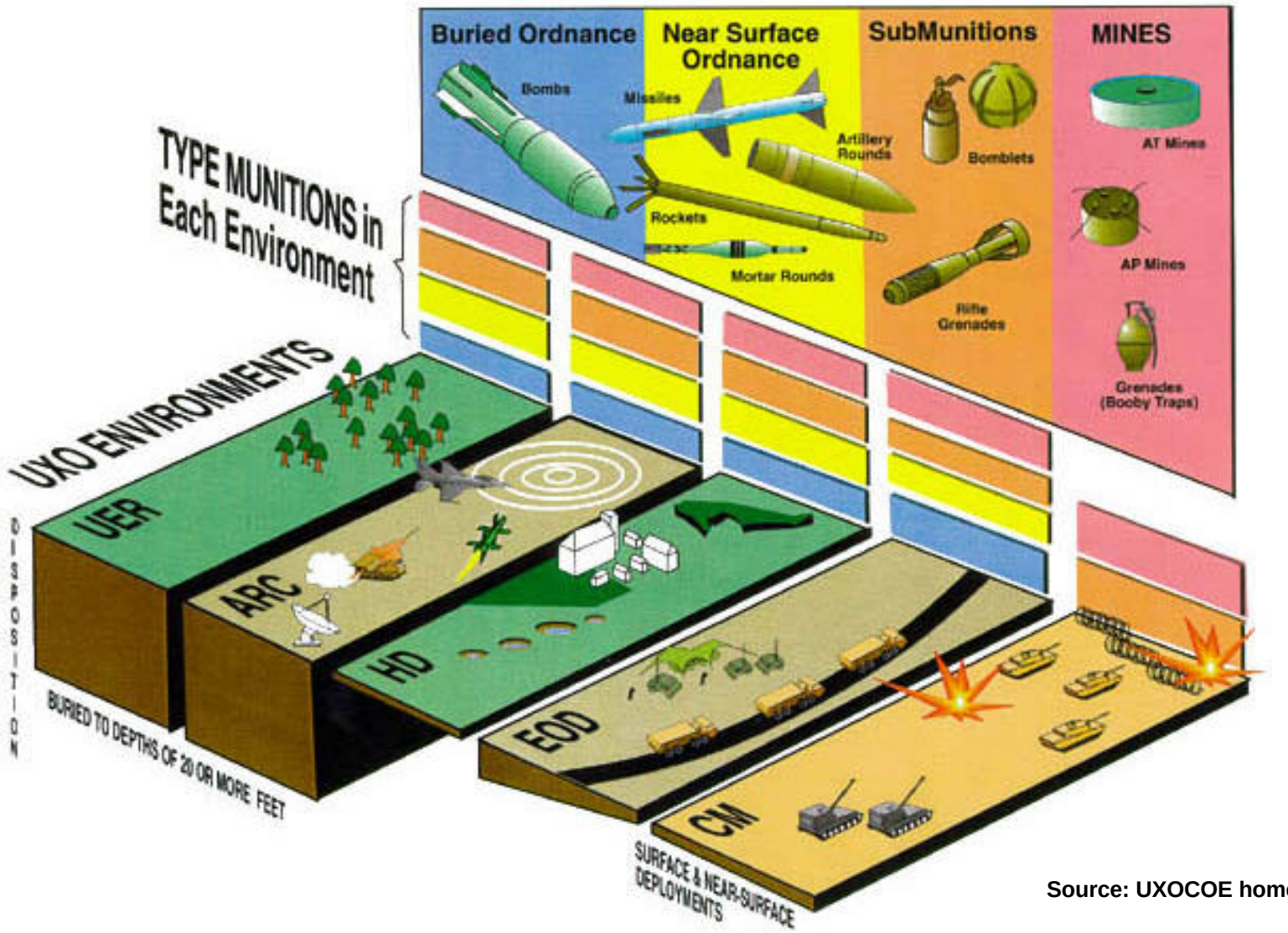
UXO Clearance Mission Areas



- Countermine
- Explosive Ordnance Disposal
- Humanitarian Demining
- Active Range Clearance
- UXO Environmental Remediation

UXO Threat



Source: UXOCOE homepage

Why Clear UXO from Active Ranges?

- **To allow the safe conduct of mission-essential activities:**
  - Training maneuvers
  - Weapons testing
  - Target maintenance
  - Test article recovery…
- **To remove surficial anomalies that could affect the outcome of weapons testing.**
- **To comply with environmental and safety regulations and ensure sustainable range management.**

Range Clearance Policy

- **Unexploded Ordnance Safety on Ranges (DODI 6055.14)**
  - Clear UXO consistent with stated mission and continuing viability
- **Military Munitions Rule**
  - Addresses UXO and range residue off range
- **DoD Range Rule**
  - Impacts remediation of closed ranges at active installations
- **Environmental & Explosive Safety on Active and Inactive Ranges (DODI 4715.aa & .ab)**
  - Undergoing coordination
  - Sustainable range management; generate plans
  - DUSD-ES proponent for ARC; will designate Executive Agent

Status of ARC Technology

- No RDT&E proponent until 1997
- Range clearance not part of EOD mission
- Minimal technology development done by individual ranges
- Standard EOD detection tools exhibit very high false alarm rates in ARC environment
- Clearance is generally limited to surface, and prevalent detection methodology is visual
- Improvements are needed in the processes and technology for certifying range residue

Tri-Service Coordination

- DUSD(ES) is the designated proponent for ARC
- Lead Service not yet designated
- Requirements evolved to date have not been validated by Services at staff level

ARC Requirements Determination

- **Initiated by DTSE&E, executed by ARL**
- **Ad hoc process**
- **Meetings & site visits & surveys**
- **Requirements Workshop (Sep 96)**
  - Initial set of 29 ARC technology requirements
  - Several critical ARC issues
- **Harmonization with other mission areas**
- **Ongoing coordination**

Who provided inputs?

- **Personnel from (~15) major Army/Navy/Air Force ranges**
  - EOD
  - Range control
  - Target maintenance
  - Test recovery
- **Other DoD/contractor activities**

Functional Areas

• **Detection**	**Determine the presence of UXO**
• **Location**	**Determine the precise geographic position of detected UXO; includes actions to map or mark locations**
• **Access**	**Attain sufficient physical proximity to UXO by personnel and/or equipment to enable further actions**
• **Identification/ Evaluation**	**Determine the specific type, characteristics, hazards, and present condition of UXO**

Functional Areas (cont)

- **Neutralization** — Actions taken to neutralize UXO either by preventing the functioning of the UXO or by intentionally disrupting normal operation of the UXO
- **Recovery** — Remove UXO from the location where detected
- **Disposal** — Dispose of UXO, once neutralized and recovered, by detonation in place or removal to an authorized disposal site
- **Training** — Techniques and devices for training UXO clearance personnel

Technology Requirements: DETECTION

- **Detect Surface & Shallow Buried UXO (to 2 ft) (H)**
  - High PD (95-100%) and discrimination capability
  - Position to within 1 ft
  - Man portable system: $10K, walking rate
  - Remote system: $50K, 100 acres/day
- **Detect Buried UXO (to 20^{+} ft) (H)**
  - High PD (90-100%) and discrimination capability
  - Position to within 2 ft
  - Man portable system: $20K, walking rate
  - Remote system: $75K, 100 acres/day
- **Rapid, Wide Area UXO Screening (L)**
  - High PD (95%) and discrimination capability
  - Position to within 3 ft
  - Airborne system: $500K, 5,000 acres/day

Technology Requirements: LOCATION

- **Ruggedized In-Flight Munitions Tracking System (H)**
  - Facilitate mapping and/or recovery of munitions
  - 10 m accuracy
  - $0.5K per device; $5K per base station
- **Data Base System to Collect, Store, Analyze, Disseminate Information (H)**
  - Data base for recording UXO locations to support mission planning of testing, training, and range clearance activities
- **Automated Digital Mapping System (H)**
  - Automated system used with detection system for recording digital information on UXO locations

Technology Requirements: ACCESS

- **Personnel protective ensemble (H)**
  - Lightweight system that protects against high-speed fragmentation
  - Exceed:
    - NIJ Threat Level IV to the head, body and lower extremities
    - ANSI-Z 87.1 for impact resistance for eye protection
    - ANSI Z 80.3 for UV eye protection
    - ANSI Z 81.6 for laser eye protection
- **Improved robotics for accessing and recovering ordnance (H)**
  - Non-line of sight control; 1 mi. standoff
  - Excavate/recover intact UXO (up to 2,000 lb. bombs at 30 ft)
  - Fine manipulation to support access, neutralization, and disposal activities

Technology Requirements: ACCESS (cont)

- **Kit to protect vehicles from UXO detonation (H)**
- **Defeat anti-disturbance features of UXO (L)**
  - Defeat anti-disturbance features (e.g., electronic/mechanical break wires and trip wires)
  - Gain access without causing initiation (with 98-100% reliability)
- **Gain access to internal area of UXO (L)**
  - Gain access to explosives or embedded fuzing systems without actuating device

Technology Requirements: IDENTIFICATION

- **UXO filler analyzer (H)**
  - Distinguish between hazardous and inert fillers
- **3-D external imager and UXO identifier (M)**
- **Internal imager of buried UXO (M)**
- **Monitor status of fuzes during EOD operations (L)**
- **Type identify buried objects (to 10 ft) (L)**
- **Examine standoff weapons without actuating sensors (L)**
- **Remotely determine status of electronic fuze (L)**
- **Identify presence of known chem/bio agents (L)**

Technology Requirements: NEUTRALIZATION

- **Advanced UXO deflagration/detonation system (H)**
  - Use focused directed energy to deflagrate/detonate UXO
  - Programmable target locations
  - Standoff of 50-450 m
  - Desired rate of 10 per hour
- **Desensitizing of explosive material to allow for separation of hazardous components (M)**
- **Remotely neutralize hidden or embedded electronic fuze systems and verify safe condition (L)**

Technology Requirements: DISPOSAL

- **Mechanized system to remove explosive contaminants from residue and certify ordnance as explosive free (H)**
  - Transportable system
  - Process training munitions, lightweight munitions components, residue from live munitions
  - Cut, shred, crush inert-filled bombs, training munitions, etc.
- **Remotely operated system to windrow submunitions (H)**
  - Disturb and windrow improved conventional munitions (ICM)
  - Survive detonations of ICM in close proximity
- **Capture, separate, contain, hazardous (explosive & toxic) waste (H)**

Technology Requirements: RECOVERY

- **System to recover shrapnel & other range residue (H)**
  - Manned and/or robotic collection
  - 10 acres per day
  - Collect hazardous and non-hazardous munitions residue ranging from 20-mm projectiles to 500-lb bombs

Technology Requirements: TRAINING

- **Training aids (H)**
  - Surrogate UXO for personnel training aids

ARC Summary

- The requirements determination process to date has been ad hoc
- No formalized Tri-Service requirements coordination process is in place
- Technology requirements not yet sanctioned by Services
- Effort to identify lead Service and requirements determination process is ongoing
- Policy/regulations for active range clearance still evolving